REMARKS

Claims 1 – 6 and 8 – 21 are presently pending. In the above-identified Office Action, the Examiner objected to the Specification, and Claims 1, 2 and 21. Claim 20 was rejected under 35 U. S. C. § 112, second paragraph. Claims 1 – 4, 7, 8 and 21 were rejected under 35 U.S.C. § 102(b) as being anticipated by Applicants' Admitted Prior Art (AAPA). Claims 5, 6 and 9 – 20 were rejected under 35 U.S.C. § 103(a) as being unpatentable over AAPA.

Applicants have addressed the objections to the Specification and claims as follows: Claim 1 was amended to provide proper antecedent basis for all elements, Claim 21 was canceled, and a replacement for FIG. 1 is provided. The replacement FIG. 1 includes only reference numerals that are disclosed in the specification.

Claims 1 – 20 stand rejected as anticipated by, or unpatentable over, Applicants' Admitted Prior Art. For the reasons set forth more fully below, Applicants respectfully submit that the subject Application properly defines an invention patentable over the Prior Art. Reconsideration, allowance and passage to issue are therefore respectfully requested.

The invention addresses the need in the art for a system and method for effecting outgoing wavefront sampling and correction for space-based and other high-energy laser applications. In an illustrative embodiment, the inventive beam control system provides a first beam of electromagnetic energy; samples the first beam and provides a second beam in response thereto. The system then detects aberrations in the second beam and corrects aberrations in the first beam in response to the detected aberrations.

In a specific implementation, the invention includes a beam director telescope having a primary mirror on which a holographic optical element is disposed. The holographic optical element samples the **output** high-power beam and provides a sampled beam to a wavefront sensor. The wavefront sensor provides signals to an adaptive optics processor. The adaptive optics processor analyzes the sampled wavefront,

detects aberrations therein and provides a correction signal to an optical phased array. Consequently, the output beam is compensated for the optics of the system, including the beam director telescope.

A master oscillator provides a low power reference beam, which illuminates the optical phased array and provides a beam-path wavefront error corrected signal in response thereto. After sampling the refractive distortion in the aperture sharing element (ASE) the beam-path wavefront error corrected signal illuminates the back of the ASE and back reflects off the front surface of the element. This signal, in turn, is conjugated by the first phase conjugate mirror and transmitted through the ASE to the second phase conjugate mirror. The second phase conjugate mirror conjugates the transmitted signal thus canceling the effect of the first phase conjugation process. This signal is then amplified and front reflected off the front surface of the ASE to provide the output beam to the beam director telescope, where it is directed to the target. As the front and back reflections off the front surface of the aperture sharing element are phase conjugates of one another, the reflective distortion due to this element, which is not shared by the target track sensor optical path, is removed. Refractive distortions, which are not shared by the target track sensor optical path such as in the aperture sharing element, laser amplifiers, and other optical elements are also removed in this embodiment via the wavefront reversal properties of the first and second phase conjugate mirrors. The residual optical distortions in the laser beam path from the master oscillator output to the target are, therefore, essentially the same as the optical distortions from the target to the target track sensor; and the correction signal applied to the optical phased array also corrects the beam path for the target track sensor.

Hence, the invention provides an integrated phase conjugate laser and adaptive optics control architecture that does not require target loop wavefront sensing and employs outgoing wavefront sampling of the primary beam director mirror.

The invention is set forth in claims of varying scope of which Claim 1, as amended, is illustrative. Claim 1 now reads as follows:

> 1. A beam control system comprising:
> first means for providing a first beam of electromagnetic energy;
> second means for sampling said first beam **at an output of said first means** and providing a second beam in response thereto;
> third means for detecting aberrations in said second beam; and
> fourth means, responsive to said detected aberrations, for correcting aberrations in said first beam, said fourth means including adaptive optical means with a phase conjugate amplifier beamline for predistorting said first beam to correct for said aberrations. (Emphasis added.)

None of the references, teach disclose or suggest the invention as presently claimed. That is, none of the references, taken alone or in combination, teach, disclose or suggest a beam control system having means for detecting aberrations at an output of a means for providing a beam of energy and correcting those aberrations with adaptive optical means having a phase conjugate amplifier beamline.

In the above-identified Office Action, the Examiner relied heavily on AAPA. AAPA is shown in Fig. 2 and discussed in the subject Specification from page 10, line 10 to page 11, line 28. However, as noted on page 12, lines 5 – 10, the present invention differs from AAPA in that: 1) the local loop and target loop functions are independent and 2) the outgoing wavefront is sampled on the output side of a beam director telescope.

Thus, the Claims have been amended to include a limitation directed to output side wavefront sampling. The limitation is shown in bold above for emphasis. Clearly, AAPA does not teach, disclose or suggest a beam control system as claimed with output wavefront sampling. Accordingly, reconsideration, allowance and passage to issue are respectfully requested.

Finally, the Examiner rejected Claim 20 under 35 U. S. C. § 112, second paragraph. The Examiner asserts that the elements of the claim lack inter-relation and functionality. However, inasmuch as the claim is not a means plus function claim, a functional connection between elements is not required. Further, the claim elements are inter-related. For the convenience of the Examiner, the inter-relation between elements is emphasized in bold below. Claim 20 recites:

20. A beam control system comprising:
a telescope having a primary mirror;
a holographic element **disposed on said primary mirror;**
a wavefront sensor **in optical alignment with said holographic optical element;**
a processor operatively **coupled to said wavefront sensor;**
an optical phased array **operatively coupled to said processor;**
an aperture sharing element;
a source of a reference beam **adapted to illuminate said phased array and said aperture sharing element;**
a first phase conjugate mirror **in optical alignment with said reference beam;**
a second phase conjugate mirror **in optical alignment with said reference beam;** and
an amplifier **in optical alignment with said second phase conjugate mirror.**

Claim 20 should be allowable as AAPA does not disclose the use of HOEs on the primary mirror of a telescope. Further, the use of HOEs on the primary mirror is not obvious over AAPA inasmuch as there is no need to sample the output wavefront in AAPA as the wavefront is sampled before the telescope.

Accordingly, reconsideration, allowance and passage to issue are respectfully requested.

Respectfully submitted,
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